Transactions of the Royal Society of S. Aust. (2001), **125**(1), 15-23.

NEW SPECIES OF *OTIONELLINA* AND *SELENARIA* (BRYOZOA-CHEILOSTOMATA) FROM THE SOUTH WEST SHELF, WESTERN AUSTRALIA

by T. J. Conroy*, P. L. Cook† & P. E. Bock†

Summary

Conroy, T. J., Cook, P. L. & Bock, P. E., 2001 New species of *Otionellina* and *Selenaria* (Bryozoa-Cheilostomata) from the South West Shelf, Western Australia. *Trans. R. Soc. S. Aust.* **125**(1), 15-23, 31 May, 2001.

Recent sediment samples recovered from the mid-latitude South West Shelf (SWS) of Western Australia (23° - 32°S) by a scientific team aboard the RV *Franklin* have produced large numbers of free-living, lunulitiform bryozoans. Among these are three undescribed species, *Otionellina boneae* sp. nov., *Selenaria kayae* sp. nov., and *Selenaria meganae* sp. nov. The Australasian lunulite fauna is both diverse and abundant and the new species bring the total of described taxa to sixty (P. Cook unpub.). Twelve lunulite species have been recorded from the SWS. These findings have extended the known geographical range of several lunulite species.

Key Words: *Otionellina boneae* sp. nov., *Selenaria kayae* sp. nov., *Selenaria meganae* sp. nov., new species, lunulite bryozoans, South West Shelf, Western Australia.

Introduction

The mid-latitude continental margin of Western Australia represents a transition from cool-water carbonate production to warm-water tropical carbonate production (Fig. 1)(Conroy 1996[1]). This paper provides the first documentation of the nature, density and distribution of Recent lunulite bryozoans on the SWS. Despite extensive research on the Leeuwin Current, the bottom sediments of the wave-dominated, open continental shelf are relatively unreported upon.

Detailed analysis of the sediments collected by a scientific team aboard the RV *Franklin* in 1996 has revealed the presence of 12 species of lunulite bryozoans, three of which are hitherto undescribed. These bryozoans include two species of *Helixotonella*, *H. spiralis* (Chapman 1913) and *H. scutata* (Cook & Chimonides 1984b), three of *Otionellina*, *O. australis* (Cook & Chimonides 1985b), *O. nitida* Maplestone, 1909 and *O. boneae* sp. nov., five of *Selenaria*, *S. maculata* (B) (Busk 1852b), *S. punctata* (Tenison-Woods 1880), *S. variolans* (Cook & Chimonides 1987), *S. kayae* sp. nov. and *S. meganae* sp. nov. and two of *Lunularia*, *L. capulus* (Busk 1852a) and *L. repanda* (Maplestone 1904) (Table 1).

Lunulite bryozoans may be locally abundant and live upon or within the upper layers of the bottom sediments, supported and stabilised by the extended mandibles of the peripheral and subperipheral avicularia. The avicularian morphology of *O. boneae* sp. nov. makes it unlikely that it is capable of colony locomotion like that of *O. symmetrica* (Cook & Chimonides 1984a), the only species of this genus which has been observed alive. The colonies of *S. kayae* sp. nov. and *S. meganae* sp. nov. have no avicularian mandibles preserved but their skeletal morphology suggests that they had the capacity for locomotion, as in all observed species of *Selenaria*. Observations on living material of the three new species would assist in the understanding of the correlation between skeletal and mandibular morphology and avicularian function.

Materials and Methods

Abbreviations of institutions which are repositories of the specimens referred to in this paper are: South Australian Museum, Adelaide (SAMA), Department of Geology and Geophysics, University of Adelaide (UA), Museum Victoria, Melbourne (MU), British Museum (Natural History), London (BMNH).

Sediment samples were collected by towing an epibenthic sled along the sea floor at a speed of two knots for three to five minutes. This provided a mixed sample of surface and subsurface material

* Dept of Geology and Geophysics, The University of Adelaide SA 5005.
Current address: Santos Ltd, Santos House 91 King William St Adelaide SA 5000.
† School of Ecology and Environment, Rusden Campus Deakin University Clayton Vic. 3168.

[1] Conroy, P. (1996) Vagrant Bryozoans from the South West Shelf, W.A., Their distribution, taxonomy, geochemical characteristics and relevance to palaeoecological studies. BSc (Hons) Thesis, University of Adelaide (unpub.).

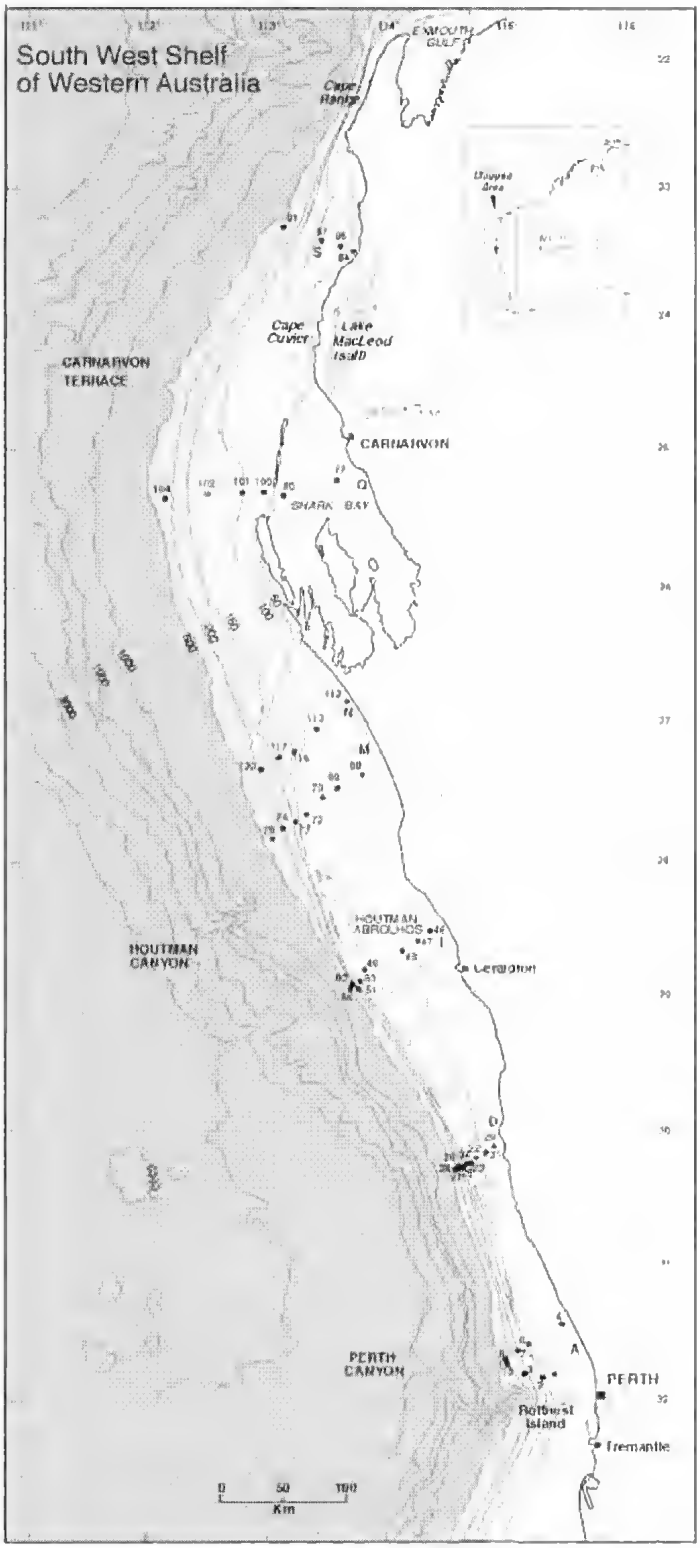

Fig. 1. Map of the South West Shelf, Western Australia showing transects, location sites and bathymetry.

TABLE 1. *Species counts from the SWS.*

Species	Living specimens	Non - living specimens	Total
H. scutata	52	916	968
H. spiralis	5	209	214
L. capulus	33	86	119
L. repanda	0	10	10
O. australis	3	139	142
O. nitida	3	103	106
O. boneae sp. nov.	9	63	72
S. maculata	313	772	1085
S. punctata	12	1924	1936
S. varians	2	399	401
S. kayae sp. nov.	0	196	196
S. meganae sp. nov.	0	256	256

from a depth of approximately 100 - 150 mm. The sampling was conducted along transects across the continental shelf, shelf edge, slope and abyssal plain of the SWS between 23° and 32° S and from depths ranging from 39 - 314 m (Tables 2, 3). Measurements of *Otionellina* and *Selenaria* species are recorded in Table 4.

Sea floor sediment samples range from 0.4 kg to 2 kg in weight. Recorded lunulite bryozoan numbers are the total number of lunulite bryozoans present in the available sediment samples.

Specimens were cleaned ultrasonically in a 1:50 solution of commercial strength bleach and water before being rinsed in deionised water, dried and coated with a gold-palladium mixture for scanning electron microscopy (SEM).

Identification of colonies

Many of the colonies, preserved within the fine-grained sea-bottom sediments where they had lived and died, were relatively undamaged and included cuticular structures such as opercula and avicularian mandibles intact. Even if these were absent, the skeletal structure was complete. The amount of wear and breakage depends both on the nature of the sediment and the initial robustness of the species. *Otionellina boneae* sp. nov. colonies are up to 5 mm in diameter and are heavily calcified and flat basally. They are so robust that they are generally found as whole colonies with undamaged zooids and so the species are readily identified. Colonies of *Selenaria kayae* sp. nov. are also basally thickened with flattened margins at the periphery of sexually mature colonies formed by calcified kenozooids; this helps to preserve them in their entirety. In contrast, colonies of *S. meganae* sp. nov. are flat and thinly calcified basally and are generally fragile. This species is difficult to distinguish from others unless its colonies are sexually mature and have an undamaged ancestrular region.

Systematics

Order Cheilostomatida Busk, 1852
Family Otionellidae Bock & Cook, 1998
Genus *Otionellina* Bock & Cook, 1998
Type species: *Otionella australis* Cook & Chimonides, 1985

Colonies budded radially from an ancestrula which has one distal and one proximal adjacent avicularium. Basal surface flat or concave, formed by sectors of porous extrazooidal calcification. Autozooids with small rounded or oval opesia and well-developed cryptocyst. Brooding zooids marginal with an enlarged opesia; skeletally distinct male zooids unknown. Avicularia smaller than autozooids, with paired condyles, which may be fused in some species; opesia symmetrical or asymmetrical, open, or closed by a porous cryptocyst lamina. Mandibles spoon-shaped, or more elongated, with two expansions and serrate margins. Note that Bock & Cook (1998) separated this genus from *Otionella* devised by Canu & Bassler (1917).

Otionellina boneae sp. nov.
(FIGS 2-4)

Material examined

Holotype: Sample 85B, Transect S, 23° 26.57' S, 113° 45.22' E, 50 m, 21.i.1996, SAMA, SAM L894.
Paratypes: Sample 85B, Transect S, 23° 26.57' S, 113° 45.22' E, 50 m, 21.i.1996, SAMA, SAM L895.
Other material: Sample 101B, Transect Q, 25° 18.29' S, 112° 48.36' E, 100 m, 23.i.1996, MV, F86428; Sample 102B, Transect Q, 25° 18.01' S, 112° 33.97' E, 121.1 m, 23.i.1996, MV, F86429; Sample 102B, Transect Q, 25° 18.01' S, 112° 33.97' E, 121.1 m, 23.i.1996, BMNH, 1999.11.18.1; Sample 102B, Transect Q, 25° 18.01' S, 112° 33.97' E, 121.1 m, 23.i.1996, UA.

Description

Colonies bun-shaped, solid basally, with a few irregular sector boundaries and small pores; sexually mature with peripheral brooding zooids by the fifth to eighth astogenetic generations. Autozooids with

Fig. 2. *Otionella boneae* sp. nov. Mandible. Scale bar = 0.50 mm.

TABLE 2. *Ecological ranges of species from the SWS.*

Species	Transects	Depth in m.	Bottom temp.° C	Salinity, ‰
H. scutata	A,D,I,M,Q,S	77.1-221	18.8-22.8	35-35.8
H. spiralis	A,D,I,M,N	139-221	17.3-19.7	35.7-35.8
L. capulus	A,D,M,N	39-139	18.9-22.2	35.7-35.8
L. repanda	A,D	97-158	18.9-19	35-35.8
O. australis	A,D,I,M,Q,S	50-221	18.8-24	35.2-35.8
O. nitida	N,Q,S	50-100	22.8-24	35.2-35.36
O. boneae sp. nov.	A,N,Q,S	50-121	22.3-22.5	35-35.4
S. maculata	A,D,M,N,Q,S	50-221	18.8-24	35-35.8
S. meganae sp. nov.	D,M,N,Q,S	50-170	18.8-24	35-36
S. punctata	A,D,I,M,N,Q,S	44-203	17.3-22.8	35.2-35.8
S. kayae sp. nov.	A,D,M,N,Q	66-221	18.9-23	35.4-36
S. varians	A,D,M,Q,S	66-158	18.9-23	35-36

TABLE 3. *Details of transects.*

Line	Location	Starting latitude and longitude of transect	Finishing latitude and longitude of transect
A	NW of Perth	31°45.21′ S, 115°24.17′ E	31°43.36′ S, 115°00.47′ E
D	Off Green Head	30°09.47′ S, 114°53.50′ E	30°20.31′ S, 114°35.57′ E
I	NW of Geraldton	28°32.14′ S, 114°21.90′ E	28°52.42′ S, 113°43.50′ E
M	NW of Bluff Point	27°27.21′ S, 113°57.94′ E	27°50.18′ S, 113°06.13′ E
N	S of Zuytdorp Cliffs	26°54.45′ S, 113°42.33′ E	23°18.18′ S, 113°08.65′ E
Q	N of Shark Bay	25°11.52′ S, 113°35.12′ E	24°42.00′ S, 113°23.00′ E
S	Cape Farquhar	23°28.89′ S, 113°37.02′ E	23°17.11′ S, 113°02.71′ E

TABLE 4. *Measurements in mm of species of* Otionellina *and* Selenaria *described here.*

	Otionellina boneae sp. nov.	*Selenaria kayae* sp. nov.	*Selenaria meganae* sp. nov.
Lan	0.46-0.50	0.13-0.16	0.18-0.24
lan	0.23-0.25	0.11-0.13	0.12-0.15
Lz	0.30-0.39	0.21-0.25	0.24-0.27
lz	0.27-0.37	0.25-0.27	0.24-0.27
Lop	0.11-0.13	0.08-0.13	0.08-0.12
lop	0.09-0.11	0.08-0.09	0.08-0.11
Lbrz	0.28-0.38	0.20-0.26	0.20-0.25
lbrz	0.35-0.40	0.25-0.31	0.22-0.25
Lbrop	0.13-0.15	0.11-0.14	0.08-0.10
lbrop	0.13-0.15	0.11-0.13	0.08-0.09
Lm	——	0.23-0.35	0.25-0.33
lm	——	0.29-0.35	0.25-0.26
Lmop	——	0.07-0.09	0.18-0.22
lmop	——	0.07-0.08	0.07-0.08
Lav	0.14-0.3	0.25-0.35	0.22-0.37
lav	0.15-0.26	0.29-0.40	0.19-0.25

Length and width of ancestrula (Lan, lan); length and width of autozooid (Lz, lz); length and width of autozooid opesia (Lop, lop); length and width of brooding zooid (Lbrz, lbrz); length and width of brooding zooid opesia (Lbrop, lbrop); length and width of male zooid (Lm, lm); length and width of male zooid opesia (Lmop, lmop);); length and width of avicularium (Lav, lav).

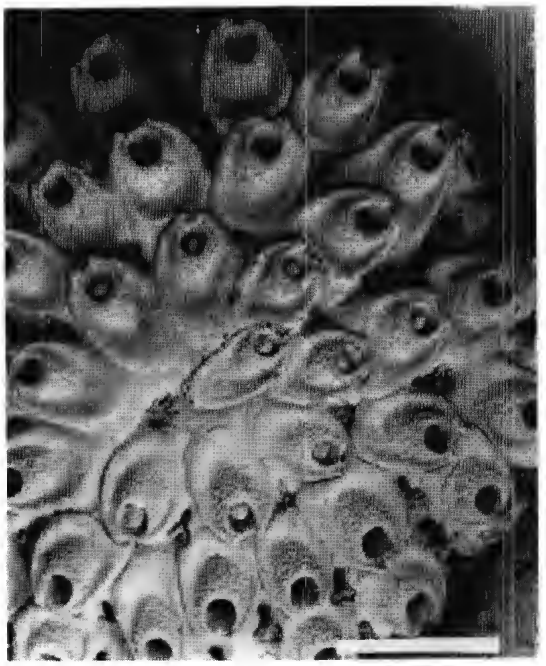

Fig. 3. *Otionella boneae* sp. nov. Whole colony with ancestrula, directed to the right and periancestrula autozooids with long gymnocysts. Scale bar = 0.50 mm.

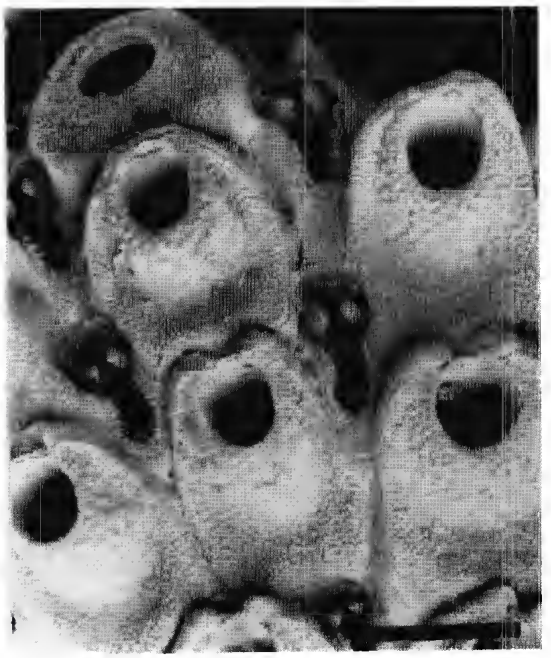

Fig. 4. *Otionella boneae* sp. nov. Autozooids, marginal brooding zooids and avicularia. Scale bar = 0.20 mm.

raised margins but rim of cryptocyst deficient distally with small protuberances. Opesia oval. Brooding zooids with circular opesia and no protuberances. Avicularia in contiguous radial series, symmetrical with elongated open opesia and paired condyles. Mandible elongated with a terminal expansion and slightly serrated margins. Basal avicularia absent.

Etymology

Named for Y. Bone, Department of Geology and Geophysics, University of Adelaide.

Remarks

Otionellina boneae sp. nov. resembles *O. nitida* from the southern and eastern coast of Australia in its raised zooids and contiguous radial series of avicularia. The avicularia differ in having an open opesia with no cribriform cryptocyst lamina. Another somewhat similar species, *O. zelandica* (Cook & Chimonides 1984a), has distinctly asymmetrical avicularia which only rarely occur in distal contiguous pairs marginally. The distal cryptocyst protuberances of *O. boneae* sp. nov. resemble those of fossil *O. cupola* (Tenison-Woods 1880). However, *O. cupola* has distinct brooding zooids with tubercules which *O. boneae* sp. nov. lacks (Cook & Chimonides 1985b).

Otionellina boneae sp. nov. appears to be a distinct Western Australian species. The two colonies from Site 85 are significantly larger (diameter 5 mm at the eighth astogenetic generation) than those from Site 101 (diameter 2.5 mm at the sixth astogenetic generation). The opercula and mandible are dark brown, the mandibles are longer than those of *O. zelandica* which they otherwise resemble. The longest, from a seventh generation position, measures 0.82 mm compared to 0.5-0.65 mm for *O. zelandica*. No basal avicularia are present at colony maturity.

Family Selenariidae Busk, 1854
Genus Selenaria Busk, 1854
Type species: *Lunulites maculata* Busk, 1852

Description

Colonies budded radially from an ancestrula which rarely has any adjacent avicularium. Basal surface formed by extrazooidal calcification with radial sector boundaries and pores. Autozooid opesia sometimes with paired opesiules. Colonies composed of concentric zones of closed central zooids, autozooids, female zooids and marginal male zooids. Avicularia very large, scattered, with a complex condyle and musculature system and, very often, a complete cryptocyst. Mandibles elongated and setiform.

Selenaria appears to be distinct from all other lunulite genera and is regarded as the only member attributable to the Family Selenariidae by Bock & Cook (1998, 1999).

Selenaria kayae sp. nov.
(FIGS 5, 6)

Material examined

Holotype: Sample 100B, Transect Q, 25° 17.96′ S, 112° 59.13′ E, 77.1 m, 23.i.1996, SAMA, SAM L896.

Paratypes: Sample 100B, Transect Q, 25° 17.96′ S, 112° 59.13′ E, 77.1 m, 23.i.1996, SAMA, SAM L897.

Other material: Sample 101B, Transect Q, 25° 18.29′ S, 112° 48.36′ E, 100 m, 23.i.1996, MV, F86427; Sample 102B, Transect Q, 25° 18.05′ S, 112° 33.97′ E, 121.1 m, 23.i.1996, MV, F86426; Sample 102B, Transect Q, 25° 18.05′ S, 112° 33.97′ E, 121.1 m, 23.i.1996, BMNH, 1999.11.18.2; Sample 102B, Transect Q, 25° 18.05′ S, 112° 33.97′ E, 121.1 m, 23.i.1996, UA.

Description

Selenaria with colonies reaching a diameter of 4 mm at 8 astogenetic generations and sexual maturity. Basal surface becoming flattened, with thick calcification and a distinct "edge" marginally, formed by kenozooids on the frontal surface. Sector boundaries very faint and pores absent except at the periphery. Autozooids with slightly elongated D-shaped opesia, female brooding zooids with larger opesia and very slightly raised distal rim. Male zooids with minute opesia and paired opesiules proximally. Avicularia large, with punctate cryptocyst and S shaped condyle system. Colonies have no intact mandibles, which are assumed to have been setiform.

Etymology

Named for K. Conroy, the mother of the principal author.

Remarks

Selenaria kayae sp. nov. closely resembles *S. minor* (Maplestone 1911) which has been redescribed by Cook & Chimonides (1985a). It differs from *S. minor* in a shorter autozooid opesia, in lacking a raised overhanging flange at the distal end of the brooding zooid and in the presence of paired opesiules in the male zooids. The flat kenozoodal "edge" of mature colonies and the large avicularia with S-shaped condyles are very like those of *S. minor*. Two other species of *Selenaria*, *S. pulchella* (MacGillivray 1895) and *S. watersi* (Cook & Chimonides 1985a), also have only the male zooids

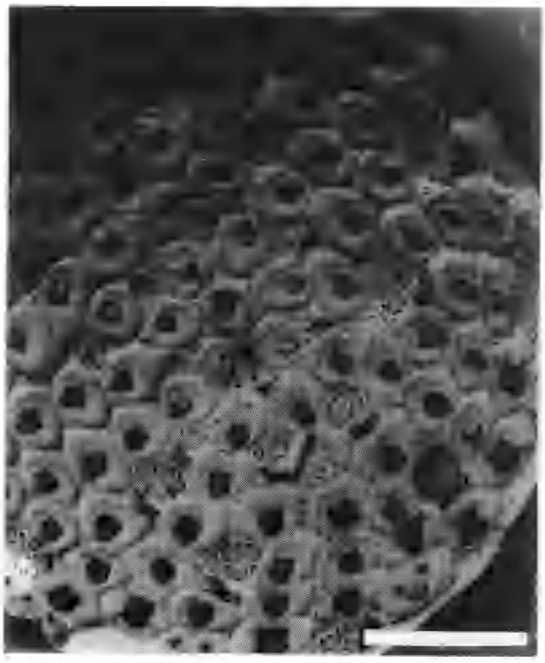

Fig. 5. *Selenaria kayae* sp. nov. Whole colony, mature, with a distinct calcified edge marginally. Scale bar = 0.50 mm.

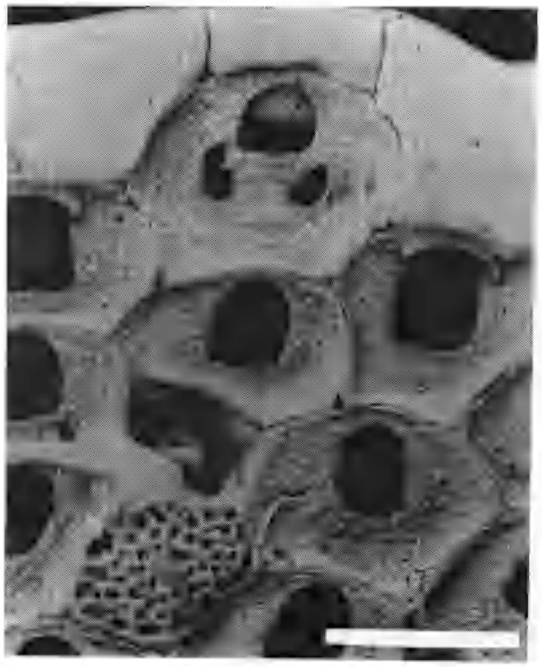

Fig. 6. *Selenaria kayae* sp. nov. Autozooids, female and male zooids, marginal kenozooids and avicularia with punctate cryptocyst. Scale bar = 0.20mm.

with opesiules but have quite different autozooidal opesiae. *Selenaria pulchella* and *S. watersi* have rounded and trifoliate opesia respectively, whilst *S. kayae* sp. nov. has elongated D-shaped opesia. *Selenaria pulchella* and *S. watersi* have avicularia with C-shaped, reflexed condyle systems in contrast to *S. kayae* sp. nov. which has S-shaped condyle systems (Cook & Chimonides 1985a).

Selenaria meganae sp. nov.
(FIGS 7-9)

Material examined

Holotype: Sample 100B, Transect Q, 25° 17.96′ S, 112° 59.13′ E, 77.1 m, 23.i.1996, SAMA, SAM L898.

Paratypes: Sample 100B, Transect Q, 25° 17.96′ S, 112° 59.13′ E, 77.1 m, 23.i.1996, SAMA, SAM L899.

Other material: Sample 101B, Transect Q, 25° 18.29′ S, 112° 48.36′ E, 100 m, 23.i.1996, MV, F86425; Sample 101B, Transect Q, 25° 18.29′ S, 112° 48.36′ E, 100 m, 23.i.1996, BMNH, 1999.11.18.3; Sample 101B, Transect Q, 25° 18.29′ S, 112° 48.36′ E, 100 m, 23.i.1996, UA.

Description

Colonies thinly calcified, basal surface not much thickened, with radial sector boundaries and numerous

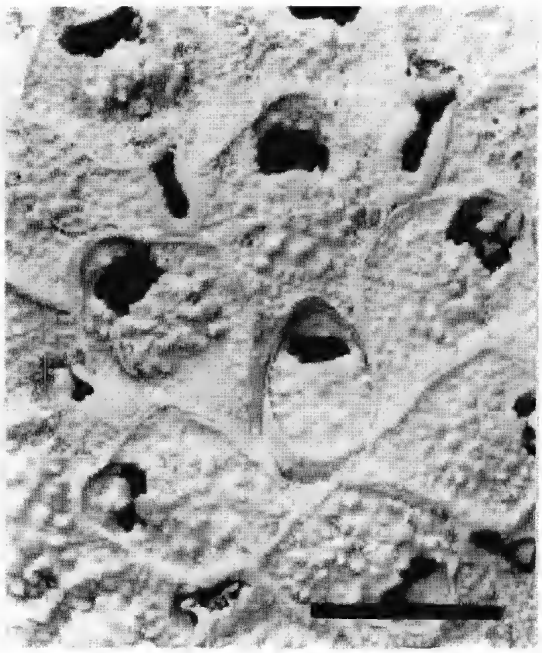

Fig. 8. *Selenaria meganae* sp. nov. Ancestrula area, directed upwards, with distinct proximal cryptocyst and no adjacent avicularia. Scale bar = 0.20 mm.

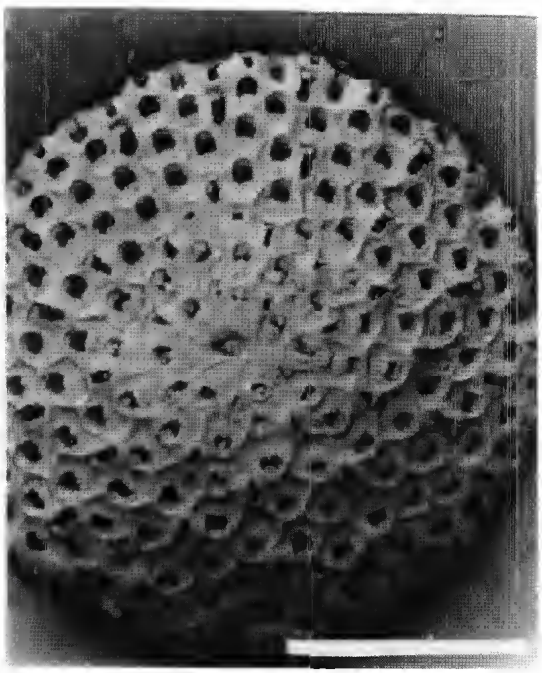

Fig. 7. *Selenaria meganae* sp. nov. Whole colony, mature, ancestrula directed left. Scale bar = 1.00 mm.

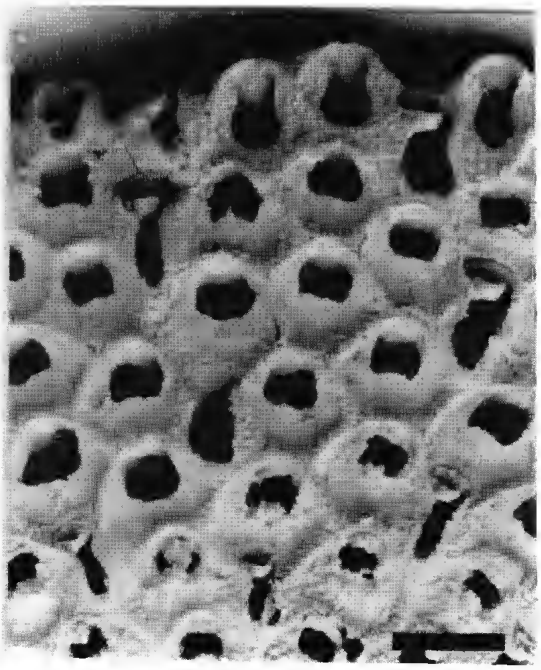

Fig. 9. *Selenaria meganae* sp. nov. Autozooids, female brooding zooids, raised distally, male zooids with narrow opesia and avicularia. Scale bar = 0.20 mm.

pores. Sexually mature at a diameter of 4 mm and the eighth astogenetic generation. Ancestrula with a distinct proximal cryptocyst and no adjacent avicularia. Autozooid opesia elongated, D-shaped, not becoming proportionally longer with astogeny. Female brooding zooids very slightly raised distally; male zooids small, with a very narrow opesia, slightly constricted laterally. Avicularia not very large, 0.22-0.37 mm in length and 0.19-0.25 mm in width, with a narrow rim of gymnocyst and cryptocyst and an elongated, open opesia. Condyle system reflexed, C-shaped; mandible not preserved, but assumed to be setiform.

Etymology

Named for M. Smith of Santos Ltd.

Remarks

Selenaria megamae sp. nov. closely resembles both *S. varians* and *S. exasperans* (Cook & Chimonides 1987). It differs from *S. varians* in the consistency of the proportions of the autozooid opesia, which do not become more elongated with astogeny. Also *S. megamae* sp. nov has narrower male zooids, (0.07-0.08 mm) compared to those of *S. varians* (0.23-0.24 mm). It differs from *S. exasperans* in the absence of any avicularia adjacent to the ancestrula and its more elongated, D-shaped autozooid opesia.

The three species of *Selenaria* appear to be closely related and form an interesting complex. It is difficult to distinguish individuals of each taxon unless the colony has a well-preserved ancestrular area and is sexually mature. *Selenaria varians* occurs with *S. megamae* sp. nov. from Western Australia. Both *S. varians* and *S. exasperans* occur together from the Great Australian Bight (Bock & Cook 1999) but most records are from Bass Strait. *Selenaria varians* is also found in New South Wales (Cook & Chimonides 1987).

Discussion

The collections of bryozoans from Western Australia offer an estimate of the diversity and abundance of lunulite bryozoans from the South West Shelf. This also includes range extensions for several species. *Helixotionella spiralis* and *H. scutata* were previously known from the Jurien Bay district of Western Australia (Parker & Cook 1994). The samples from the South West Shelf extend the recorded range of *H. scutata* north to Cape Farquhar (approximately 23°30′ S) and of *H. spiralis* north to Zuytdorp Cliff (approximately 26°45′ S) where *Lunularia capulus* also appears. *Lunularia repanda* has now been recorded from Green Head (approximately 30° S). The range of *Otionellina australis* and *O. nitida*, together with *Selenaria maculata*, *S. punctata* and *S. varians* has also been extended even further to north of Cape Farquhar. The bathymetrical range of *H. spiralis* and *H. scutata* has been extended by 73 m to 221 m. *Selenaria maculata* and *S. punctata* are the two most common species collected from the SWS and account for more than 55% of all lunulites recovered. It is interesting to note that, although a large number of lunulite colonies was collected, the majority (79%) were not living when retrieved (Table 1).

The ecological and geographical ranges of all species, including *O. boneae* sp. nov., *S. kayae* sp. nov. and *S. megamae* sp. nov. and are tabulated in Table 2.

Acknowledgments

We should like to thank Y. Bone (University of Adelaide) for providing most of the funds for this research project from an ARC Grant, S. Hageman (Appalachian State University, USA) for discussions on bryozoan taxonomy and life forms, M. Spencer Jones (British Museum Natural History, London) for providing registration numbers, L. Talbot and J. Turlett for scanning electron microscope training for the principal author (CEMMSA), P. Chimnock for his support during the principal author's honours year, the Oceanography Department of the CSIRO, and the Master and crew of CSIRO R.V. *Franklin* for their cooperation and assistance in the collection of samples from the South West Shelf of Western Australia.

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